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## **Knowledge Diffusion: A Classification of Modern Knowledge Management's Role within the Innovation Process**

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## Structured Abstract

**Purpose** – The purpose of this paper is to deliver new perspectives on and an improvement of innovation management by critically analyzing the role of knowledge management within the innovation process. This is accompanied by an assessment of organizational learning and the innovation diffusion theory that will lead to a better understanding of the distribution of innovation-related knowledge within today's organizations to benefit the innovative capacity.

**Design/methodology/approach** – We propose a mixed methods approach that includes a review of the literature to gather qualitative insights on the theories used in this research and a quantitative study that has been conducted in Saxony, Germany in 2015. The data of this study has been collected and used jointly for several innovation- and knowledge management related research projects that are linked. The Methodology of Theory Building enhances the research design of this paper by delivering a strong theoretical basis for the development of the conceptual model of knowledge diffusion within the innovation process that is proposed in this paper.

**Originality/value** – The adoption of innovation diffusion theory for knowledge and innovation management and the process of distributing and sharing knowledge within organizations as a basis for creative ideas constitute a fundamentally new approach to the topic that has not been part of the academic debate yet. It enhances the understanding of innovation processes within today's organizations and how they are permeated by knowledge.

**Practical implications** – The outcomes of this research project include a new approach to understand corporate innovation processes and especially how they emerge and how knowledge flows within organizations' work to support the innovation process. The conceptual model developed in course of this paper shows where diffusion processes within the innovation process take place and provides information on how to support or improve such processes and therefore today's companies' innovative capacity.

**Keywords** – Knowledge Management, Knowledge Transfer, Organizational Learning, Innovation Process, Innovation Diffusion.

**Paper type** – Academic Research Paper / ~~Practical Paper~~

## **1 Introduction**

Innovation is widely recognized as one of the main drivers of economic success (Avermaete et al., 2003; Chesbrough, 2003; Cooper, 1990). It is also undeniable that knowledge management is directly linked to innovation (du Plessis, 2007) and that it delivers necessary tools and information (Crossan and Apaydin, 2010) for the management of innovation. Various recent publications acknowledge this role of knowledge management as a vital part of the innovation process (Alekseevna, 2014; du Preez, Louw and Essmann, 2006). However, the diffusion of knowledge within organizations relating to Roger's theory of innovation diffusion (Rogers et al., 2005) has not been part of the academic discussion yet. For that reason, this paper aims to critically analyze the correlation between innovation management and knowledge management tools and processes under consideration of both, organizational learning and the innovation diffusion theory. This will lead to a better understanding of the distribution of innovation-related knowledge within today's organizations to benefit the innovative capacity.

## **2 Theoretical Background**

### ***2.1 Knowledge Management***

An ongoing process to understand the meaning of knowledge exists at least since the philosophy in the ancient Greek period (Nonaka and Takeuchi, 1995, p. 21). Plato supposed that knowledge is a true and justified opinion (Plato and Noble, 2003); this means that knowledge exists for an individual if this individual has a substantiated opinion about it. One can therefore say that knowledge is the entirety of skills and abilities which are used by individuals for the solution of tasks or problems (Probst, Raub and Romhardt, 1999, p. 44). The quantity of knowledge includes the theoretical insight, but also the practical rules, facts, and activities of the daily life. Fundamental for knowledge are data and information that are set into a context.

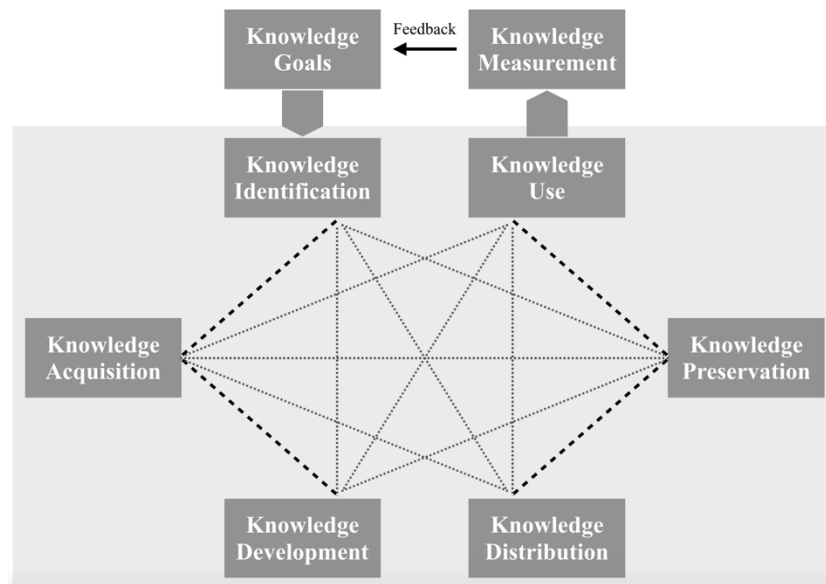
Knowledge increasingly becomes a core competence and more and more determines the value of today's organizations or companies (Delanty, 2002). According to current research results, knowledge on average represents about 80.0 % of the company value as

an immaterial business value (Daum, 2002; Mertins, Alwert and Heisig, 2005). This dominating role of knowledge causes the development of our society towards a knowledge society (Lytras and Sicilia, 2005) making individual and collective knowledge and its organization fundamental for social, political, and economical interaction (Lembke, Müller and Schneidewind, 2006).

The complexity of knowledge with all its sources implies the intricacy of knowledge management. Knowledge emerges during all business processes and each process needs certain knowledge as an input. Knowledge management itself is a process as well that includes several steps, namely capturing, storing, using, evaluating, developing, and sharing of knowledge. As it is a philosophical challenge to define knowledge and knowledge management, different models (also influenced by culture) have developed over the last decades.

One of the most recognized and well-known models is the one from Probst, Raub, and Romhardt displayed in Figure 1, which consists of the knowledge cycle including six core processes that are: 1) identification, 2) acquisition, 3) development, 4) distribution, 5) preservation, and 6) the use of knowledge, extended by the framework processes that are knowledge goals and knowledge measurement (Probst, Raub and Romhardt, 1999; 2006).

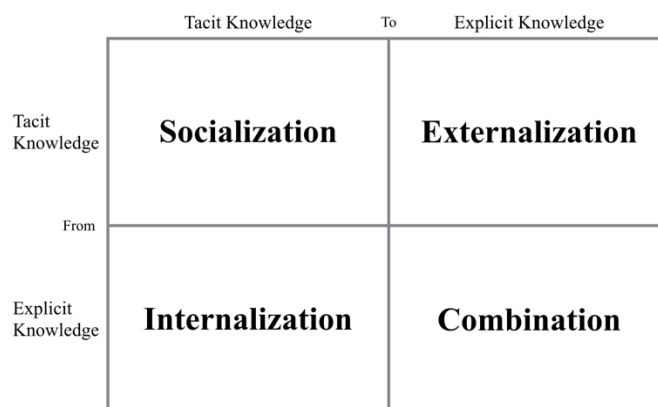
*Figure 1: Building Blocks of Knowledge Management  
(own figure according to Probst, Raub and Romhardt (1999))*



Thereby one can identify a link to knowledge diffusion in the core process of knowledge distribution and a link to the innovation process in the core process of knowledge use. In practice those core processes of knowledge management are cross-linked much closer than in a sequential cycle. For example, there can be a direct connection between capturing and sharing of knowledge.

Parallel to this, the SECI model (Socialization, Externalization, Combination, Internalization) by Nonaka and Takeuchi (1995) is considered to be important.

*Figure 2: SECI Model  
(own figure according to Nonaka and Takeuchi (1995))*



Its description of the transformation of individuals' knowledge to organizational knowledge is presented in Figure 2 above. It can take place by externalization (tacit to explicit), combination (explicit to explicit), internalization (explicit to tacit), and socialization (tacit to tacit). This is a more philosophical and social view to the organizational knowledge with a less explicit, information-technology oriented background.

Another interesting concept is the Ba-concept by Nonaka and Takeuchi (Nonaka and Konno, 1998). The term 'Ba' describes something like a room or a place, which can be mental, virtual, or physical and is shared by several individuals. The creation of knowledge takes place in the shared Ba, forced by the interactions:

- originating Ba: place where individuals exchange emotions and experiences
- interacting Ba: development of practical concepts out of the mental ideas by communication
- cyber Ba: reflection and adaption of mental models inside a virtual room

- exercising Ba: place where the explicit knowledge is internalized into tacit knowledge

This model and its philosophy is another view onto knowledge flows and knowledge transfer for individuals as well as for organizations. For example, knowledge transfer happens when a student or trainee applies its formally learned knowledge in a practical working environment. The formal knowledge will be reflected and evaluated. These recognitions added by the new knowledge from the practical project work reflow to the theoretical knowledge and improve the knowledge base. Hence, the process of knowledge transfer (Bernard and Tichkiewitch, 2008) with initiation, knowledge flow, and integration becomes reality.

These knowledge and knowledge management models and processes are fundamental preconditions for the initiation of innovation processes and the management of innovation. To generate innovation, newly developed tacit and explicit knowledge enriched and combined with information and knowledge from external sources such as e.g. markets is necessary and part of the value creation.

### ***2.3 Organizational Learning***

Learning describes the permanent process of individuals' acquisition of information, knowledge and skills. Already the American educational theorist Kolb focused his research on experiential learning and outlined his theory of learning styles in Kolb, Boyatzis and Mainemelis (2001) consisting of the information in our genes, life experiences, and the demands of our current environment.

Learning does not only take place on the individual level, but also on the team or group level and the organizational level. It consists of two dimensions that are: 1) intentional learning for reaching a focused knowledge goal and 2) implicit learning, the 'learning by doing' and learning from others. That means one aspect of learning is that one learns from history and tradition (Popper, 1987, p. 61) of mankind and ourselves and the use of the experiences of the past. Also behavior patterns can be derived from previous times. However, in our fast changing world, a second aspect develops rapidly. This is the learning by and with others or learning within teams while applying the knowledge. In this way of learning, individuals quickly reflect on recently acquired facts with feedback and evaluations. The third aspect of learning is the continuous communication of an organization's vision and strategic plans (Kemin-Buch, Unger and



Walz, 2008, p. 23). This strategy forces the members of the organization to learn and enrich knowledge and to develop competencies guiding them into focused directions. Additionally, each individual might hold a different learning type, influenced by genetic preconditions, by the environment, and by its own evolution process (Vester, 1999). That means that there are different styles of learning and thinking and also different skill levels related to visual, auditory, haptic, and cognitive learning. Consequently, this relates to the learning process of teams, groups and organizations. Although it is difficult to make generalizing statements in this research field one could state that learning takes place at different levels, contexts, and dimensions.

Organizational learning reflects on information and knowledge (tacit and explicit), applies knowledge and results in new knowledge for the individual and/or the organization. That is why learning processes are an important driver for creativity and innovation and strongly impact the innovation process.

## ***2.2 Innovation Diffusion and the Innovation Process***

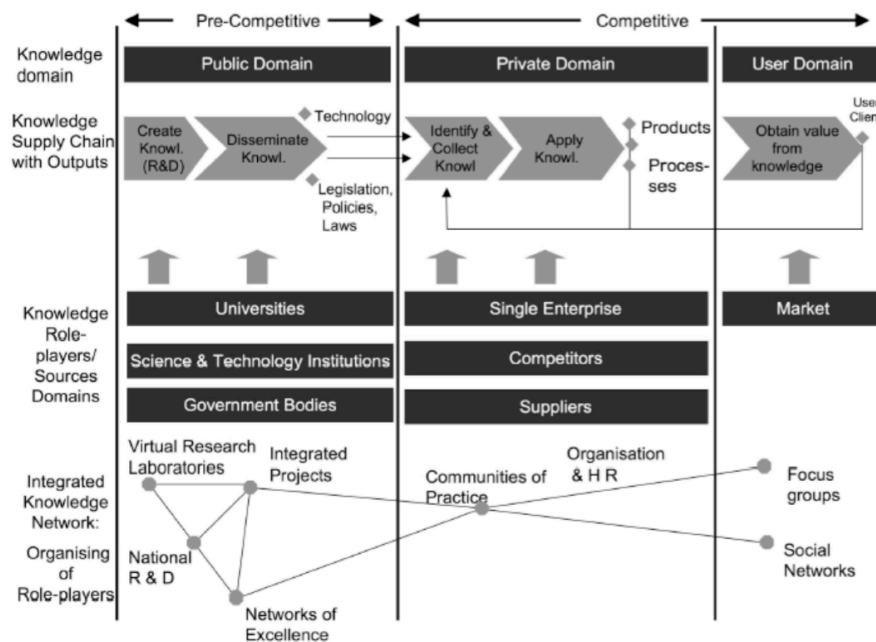
The theory of the diffusion and adoption of innovations among individuals and organizations was first published by Rogers (1962). Five key elements of diffusion research that are also applied to this paper have been identified and confirmed by various authors to be *innovation*, *adopters*, *communication channels*, *time* and the *social system* (Ghoshal and Bartlett, 1988; Meyer, 2004; Rogers et al., 2005; Strang and Soule, 1998). These aspects are of particular importance as a basis for the development of the conceptual model that is outlined in chapter four.

Rogers (2005) describes the diffusion process as a five-stage process where these key elements interact. The five stages are *knowledge*, *persuasion*, *decision*, *implementation*, and *confirmation* (Rogers et al., 2005; Ryan and Gross, 1943), which already emphasize the role of knowledge as a starting point of an innovation-related process. According to Reuther (2017) it is suggested that diffusion processes take place before, during and after the innovation process.

In course of this paper it will be assessed to what extent Rogers theory is adoptable to describe the diffusion and exchange of knowledge within organizations and to evaluate which role this aspect takes within the innovation process. Therefore, the innovation model of Du Preez and Louw (2007) that displays the knowledge supply chain for supporting innovation is considered and displayed in Figure 3 below. It assumes that

knowledge is created within a public domain that includes for example universities and that the created knowledge then needs to be identified and collected by the private domain that includes for example single enterprises. This process of identification and collection of knowledge on the corporate level strongly relates to our approach of understanding the knowledge diffusion process.

*Figure 3: Knowledge Supply Innovation Model  
(Du Preez and Louw, 2008)*



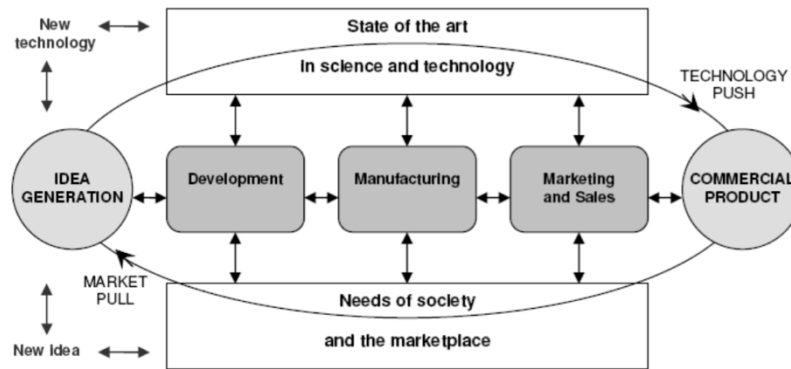
One can identify knowledge related diffusion processes at all three knowledge domains that are introduced in the model:

- 1) They take place before the actual, corporate innovation process as the diffusion of knowledge has been acquired in the public domain and is used for triggering corporate innovation.
- 2) They then take place within organizations in the private domain as the diffusion of knowledge among members of the organization when innovation processes are triggered and the innovation originators seek support for their ideas.
- 3) Lastly, they take place in the user domain after commercial products are created and then strongly relate to the classical diffusion theory according to Rogers (1962) and Bass (1969), meaning that consumer get awareness of

innovative products or services on the market and then spread the knowledge among market participants or more generally to members of the society.

As this paper focuses on understanding the role of knowledge management on the corporate level or the private domain according to the model of Du Preez and Louw (2008), an additional model describing this stage of the innovation process in more detail is needed. Therefore, the model of Rothwell (1995) displayed in Figure 4 is used. It is a five-stage model that describes the innovation process as 1) idea generation, 2) development, 3) manufacturing, 4) marketing and sales and 5) commercial product.

*Figure 4: Corporate Innovation Process Model (Rothwell, 1995)*



It is suggested that the knowledge diffusion researched in course of this paper happens during the idea generation stage and/or between the idea generation and development stage.

### 3 Methodology

This study uses a mixed methods approach combining the gathering of qualitative data using a literature analysis focusing on the above described aspects with quantitative data obtained from a survey carried out in Saxony, Germany in 2015/2016. The literature analysis is used to create the basis of the suggested model classifying knowledge diffusion within the innovation process. The survey focused on analyzing employees' willingness to share information and knowledge in their respective working environment.

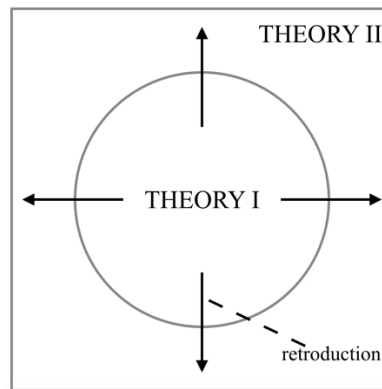
This is enhanced with the Methodology of Theory Building according to Steiner (1988). Her approach describes the development of a new theory or model out of one or more recognized theories. The theory model approach is displayed in figure 5.

*Figure 5: Theory Models Approach (Steiner, 1988)*



The development from the theory model to a new theory as it is conducted in course of this research by the development of a conceptual model of knowledge diffusion within the innovation process is related to Steiner's retroductive research approach that is displayed in figure 6.

*Figure 6: Theory Models Approach (Steiner, 1988)*



#### **4 Development of a Conceptual Model**

The adoption of innovation diffusion theory for knowledge management and the process of distributing and sharing knowledge within organizations constitute a fundamentally new approach to the topic. The use of mixed methods to gather qualitative information on relevant theories and how they are applied by now as well as quantitative data on employees' attitudes on sharing information and knowledge support the validation of the model to be developed according to Steiner's approach. In the following, the considered theories will be assessed towards their usability in the new, suggested context of knowledge diffusion as part of the innovation process.

The knowledge of organizations consists of tacit knowledge inside people's mind and the explicit knowledge is mainly saved in electronic ways, for example as files or

databases. Organizations usually have a lot of information and data that is transformable and usable as knowledge, but most of them neither have processes or strategies to make this knowledge accessible in the form of integrated processes or in education and learning activities. The most effective goal of knowledge management is to establish a knowledge transfer, the correlation between formal knowledge and knowledge gained through experiences.

It is a known fact in organizations that enormous competitive advantages can be reached by capturing, using, and developing knowledge effectively. The individuals' knowledge plays a significant role as part of the intellectual capital of organizations and constitutes an important intangible value in this context. However, most of the knowledge is bound to individuals within the organization. Consequently, the individuals learning process is stronger and more transparent than the organizational learning process, but each individual is involved in a kind of double loop learning following the personal interests as well as the organizational goals. The individual level is the inner loop and the integration of the organizational goals and visions in the learning process is the outer loop (Argyris and Schön, 1996). Thus, it is necessary to develop strategies for knowledge capturing processes inside organizations to encourage organizational learning processes and to improve the learning process as well as the knowledge transfer. This can be realized by the use of suitable knowledge management methods.

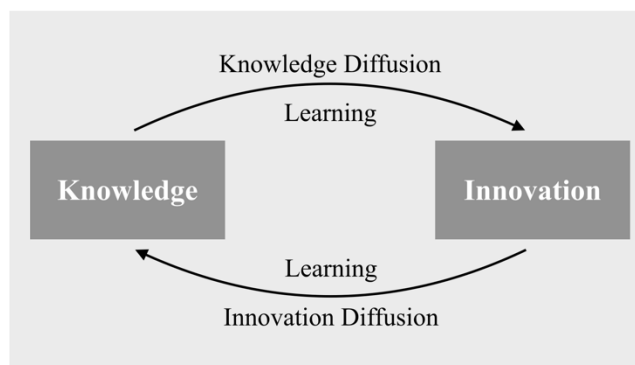
This correlation of knowledge and learning processes shows strong links to the innovation process, as it creates new knowledge on the individual and corporate level that can initiate or trigger innovation. In course of the theoretical background section, it has been shown that the diffusion of knowledge happens early in the innovation process during the idea generation stage and/or between the idea generation and development stages. The five stages of the diffusion model that are knowledge, persuasion, decision, implementation, and confirmation already indicate the link to knowledge management. An adoption of the diffusion model either to the diffusion of knowledge or creative ideas according to Reuther (2017) can describe the distribution and exchange of certain immaterial assets between individuals of an organization at the beginning of the innovation process.

The strong interdependencies of knowledge, learning and innovation already appear in the definition of innovation as “new idea, device or method”, and must be based on certain knowledge acquired through learning processes. Assuming that change processes

are initiated through processes of invention, innovation and diffusion, one can identify a loop of knowledge creation through these interdependencies, what is also emphasized through the innovation diffusion theory saying that new ideas (innovation) are derived from data, information, and knowledge.

Following this, it is interesting to analyze the diffusion of knowledge which is, on the one hand, vital for innovation while innovation returns new knowledge to individuals and the organization on the other hand. This resulting knowledge will be spread within the organization and will be processed by organizational learning. This knowledge and innovation loop displayed in Figure 7 leads to new knowledge and consequently to a potential increase of the innovative capacity.

*Figure 7: Knowledge – Innovation Loop*



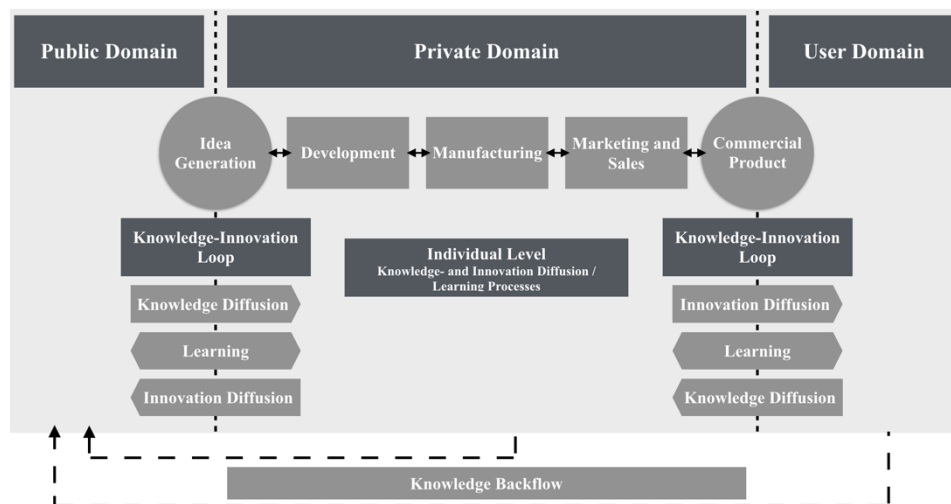
Innovation processes can be observed in the public domain, the private domain and the specialized user domain (Du Preez and Louw, 2007; Du Preez and Louw, 2008). The application of the SECI model by Nonaka and Takeuchi (1995) shows that knowledge develops from tacit knowledge into explicit knowledge, which can be spread by knowledge diffusion processes. That means tacit knowledge can be generalized into explicit knowledge in the public domain. In course of the subsequent learning process, the knowledge is transferred into the private domain where it can be combined and processed with the existing tacit and explicit knowledge. Consequently, a higher knowledge level can be reached and new ideas, insights and impressions can trigger innovation.

A further learning process develops the knowledge to market-relevant demands that are fulfilled by goods or services created in the private domain during the innovation processes that are taking place. After the diffusion of the created innovations and the included diffusion of knowledge through learning processes over a certain time, it

becomes more and more common knowledge and can be enriched by new experiences and at least partly generalized and returned to the public level of educational institutions through education services.

New knowledge will be developed by socialization (tacit) and externalization (from tacit to explicit), by combination (explicit) and internalization (from explicit to tacit) in all three knowledge domains and innovation domains. This is a fundamental knowledge creation and diffusion process that supports organizations' innovation processes. The backflow of knowledge from the realization of the innovation and the resulting experiences can be diffused via organizational learning processes in all three domains. The model based on these theories and observations is displayed in Figure 8.

*Figure 8: Conceptual Model of Knowledge Diffusion within the Innovation Process*



This model and the evaluated theories indicate a dependency on the individuals involved, in terms of their willingness to share their knowledge and to contribute their ideas so that innovation processes can emerge on a corporate level. A survey carried out in Saxony, Germany 2015 and set out in Annex I that observed the willingness of members of an organization to act as intrapreneurs (Reuther et al., 2017; Reuther and Schumann, 2016) indicates that a majority of questioned employees seeks to contribute knowledge and ideas and even feels motivated to do so.

However, it is suggested that a research of knowledge diffusion and learning processes related to the innovation process on an individual level should be assessed in more detail in future research projects.

## 5 Conclusions

In course of this paper, it has been evaluated that knowledge and innovation have strong synergies and correlations tied together by individual and organizational learning. Considering the theory of the diffusion of innovation, this phenomenon has been concluded in the so called Knowledge Innovation Loop.

Innovation needs a fundament of new and specialized knowledge that functions as an input or trigger for innovation processes. This is realized by the diffusion of knowledge from the public to the private domain as well as inside the organizations with learning processes. Throughout this procedure, knowledge can reach a higher level and enrich the innovative capacity in the private domain. If the diffused knowledge leads to a complete innovation process that reaches a market level, the classic diffusion of innovation through the social system takes place and knowledge flows back to the public domain creating new Knowledge Innovation Loops.

The developed model of knowledge diffusion within the innovation process suggests that cross-linking individual and organizational learning (Kim, 1998) and the diffusion processes of the knowledge that is created thereby are an essential part of the innovation process functioning as a basis for creative ideas emerging out of acquired knowledge to become inventions.

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## Annex I: Survey Data

### *Economic sectors in Saxony 2015*

Own Survey			Statistical Office of the Free State of Saxony		
<i>Economic sector</i>	<i>Frequency</i>	<i>Percent</i>	<i>Economic sector</i>	<i>Frequency</i>	<i>Percent</i>
<b>Agriculture</b>	<b>1</b>	<b>1.0</b>	<b>Agriculture</b>	<b>28.9</b>	<b>1.5</b>
<b>Industry</b>	<b>21</b>	<b>21.0</b>	<b>Industry</b>	<b>572.7</b>	<b>29.5</b>
manufacturing	13	13.0			
construction	8	8.0			
<b>Services</b>	<b>76</b>	<b>76.0</b>	<b>Services</b>	<b>1334.2</b>	<b>69.0</b>
public administration	24	24.0			
other services	12	12.0			
education & training	10	10.0			
healthcare	9	9.0			
trade	8	8.0			
finance & insurance	6	6.0			
tourism & gastronomy	3	3.0			
energy & water supply	2	2.0			
traffic & transport	2	2.0			
<b>Others</b>	<b>1</b>	<b>1.0</b>			
<b>n.a.</b>	<b>1</b>	<b>1.0</b>			
<b>Total</b>	<b>100</b>	<b>100.0</b>	<b>Total</b>	<b>1936.0</b>	<b>100.0</b>

### *Knowledge Contribution*

I get the opportunity to contribute my knowledge/expertise frequently.					
valid	<i>valid</i>	<i>valid</i>	<i>valid</i>	<i>valid</i>	<i>valid</i>
	<i>totally agree</i>	17	17.0	17.0	17.0
	<i>tend to agree</i>	39	39.0	39.0	56.0
	<i>neither</i>	16	16.0	16.0	72.0
	<i>tend to disagree</i>	8	8.0	8.0	80.0
	<i>totally disagree</i>	18	18.0	18.0	98.0
	<i>n.a.</i>	2	2.0	2.0	100.0
	<i>Total</i>	100	100.0	100.0	

### *Idea Participation I*

I would like to have better opportunities to participate with my ideas.					
valid		<i>Frequency</i>	<i>Percent</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
	<i>totally agree</i>	26	26.0	26.0	26.0
	<i>tend to agree</i>	29	29.0	29.0	55.0
	<i>neither</i>	19	19.0	19.0	74.0
	<i>tend to disagree</i>	7	7.0	7.0	81.0
	<i>totally disagree</i>	14	14.0	14.0	95.0
	<i>n.a.</i>	5	5.0	5.0	100.0
	<i>Total</i>	100	100.0	100.0	

*Idea Participation II*

I feel motivated to show initiative regarding my own ideas.					
valid	valid	<i>valid</i>	<i>valid</i>	<i>valid</i>	<i>valid</i>
	<i>totally agree</i>	29	29.0	29.0	29.0
	<i>tend to agree</i>	40	40.0	40.0	69.0
	<i>neither</i>	15	15.0	15.0	84.0
	<i>tend to disagree</i>	5	5.0	5.0	89.0
	<i>totally disagree</i>	8	8.0	8.0	97.0
	<i>n.a.</i>	3	3.0	3.0	100.0
	<i>Total</i>	100	100.0	100.0	